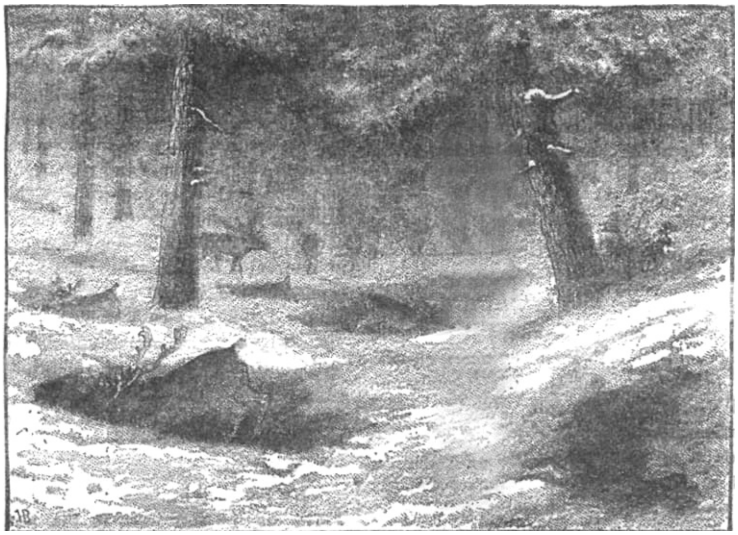
among different herds, and frequently by this the ownership can be known. The reindeer are never housed, for they like cold weather and snow. Food is never given them, and they will not touch the moss that has been gathered, unless brought up to do so. They often will not even raise their heads as you approach them, and remain quiet when the Lapps pitch their tents, as we have seen. Some years prove unfavourable to their increase, on account of the amount of snow, which prevents them from digging for food; the herd then becomes weak and emaciated, and many die. The spring is also a bad time for them; the snow melts during the day, and a thick crust forms at night, so that their feet break through, causing lameness and disease. The horns of the males, which often weigh forty pounds, attain the full size at the age of five or six years, those of the cow at about four years. The time of dropping the horns in a herd varies from March to May; in the adult animal they attain their full size in September or at the beginning of October. After the age of eight years the branches gradually drop off. The shoulder-blades appear a little high, occasioning a slight hump or protuberance. Without the reindeer the Laplander could not exist in those northern regions: it is his horse, his beast of burden; it affords him food, clothing, shoes, and gloves. Domestic reindeer are a curious admixture of wildness and tameness. In some respects they are greatly superior to other cattle; in a herd they are very easily managed; they usually keep close together, and in the winter season remain where they have been left to feed. When on the march, with the help of dogs, they go in a solid mass, and a herd does not scatter unless wolves are after them; but in summer they often wander a long distance when left by themselves, as is often the case. When harnessed they become uneasy and distrustful, and great caution has to be taken not to startle them. Often trained reindeer, like horses, become refractory or vicious, and very difficult to manage, and then the Lapp shows his skill. The speed of the reindeer varies very much according to the time of the year, October, November, and December being the months in which they are fleetest, as then they are fresh from their summer pasture; the cold weather strengthens them, and they are not exhausted from digging the snow, not yet very deep, to procure their food. The rapidity of their gait depends much on the state of the surface. If this is well packed or crusted, and if previous furrows have been made, they go very fast. Much depends too upon the distance, and whether the country is hilly or not, with a long range of slopes. On the rivers, over well-packed snow and a good track, the animals can go twelve or fifteen miles the first hour, and down a long mountain-slope twenty miles, and even more. They can travel five or six hours without stopping, the first hour rapidly, the second more slowly, and towards the fifth or sixth quite slowly, for by that time they require rest and food. Early in the winter, when they are in good condition, one can travel with a swift reindeer one hundred and fifty miles in a day, where the country is not very hilly and the way good, and easily enough one hundred miles. The colder the weather the greater is the speed: seventy or eighty miles is a good average, but they were slow at the season of which I write."



Reindeer digging in the snow.

The chapter on the Lofoden Islands gives a great deal of information about the extensive fisheries of cod, in which over 700 fishing-boats are employed.

We had marked several other extracts relating to the domestic life of the Norwegian peasants in the high north, and to the interesting people of Dalecarlia; but enough has been given to show our readers that, while the narrative of these travels is free from the exciting scenes witnessed in Gorilla Land, it is not wanting in much that will be read with pleasure and remembered with profit.

NOTES

We take the following from the *Times*:—The medals in the gift of the Royal Society for the present year have been awarded by the Council as follows:—The Copley medal to Prof. Karl Adolph Wurtz of Paris, For. Mem. R.S., for his discovery of the organic ammonias, the glycols, and numerous other investigations which have exercised considerable influence on the progress of chemistry; the Davey medal to Prof. Adolf Baeyer of Munich for his synthesis of indigo; a Royal medal to Mr. Francis Maitland Balfour, F.R.S., of Cambridge, for his numerous and important contributions to animal morphology, and more especially for his investigations respecting the origin of the uro-genital organs and the cerebro-spinal nerves of the vertebrata, and for his work on the development of the elasmobranch fishes; a Royal medal to the Rev. John Hewitt Jellett of

Dublin for his various mathematical and physical papers, more especially for his researches in chemical optics and his invention of the new and delicate analyser by which they were carried out.

The Bakerian Lecture at the Royal Society will be given next Thursday by Prof. Tyndall, on the "Action of Free Molecules on Radiant Heat, and its Conversion thereby into Sound."

The election to the Linacre Professorship of Physiology in Oxford University will take place on the 25th inst.

M. Paul Bert, the eminent Professor of Physiology at the Sorbonne, has been appointed French Minister of Public Instruction by M. Gambetta. Two hours only after his nomination had been signed by the President of the Republic he read before the Academy of Sciences an elaborate paper on "Chloroform and other Anæsthetics." This may be considered as a token of the interest that the new French Government mean to take in scientific matters. M. Cochéry, of the Post and Telegraph Department, is the only member of the old Cabinet who has taken office in the new one.

In view of the great and kindly interest the United States have always taken in English Arctic expeditions, the Council of the Geographical Society have determined to urge H.M.'s Government to undertake an expedition next year in search of the *Jeannette*. It being obviously more easy for the Americans than for this country to send an expedition by sea on the side of Behring Strait, it is thought that it would be best to despatch a party along the Great Mackenzie River to search the coast-line that can be reached from it, and that such work might most advantageously be carried out through the agency of the Hudson Bay Company. Under these circumstances it will be necessary to open communications with the Colonial Office on the subject.

The authorities of the Crystal Palace sent out on Saturday the allotments of space to the principal exhibitors of electric light at the forthcoming exhibition. If the various electric lighting companies and firms carry out their intentions, the palace will be lighted from the London, Brighton, and South Coast Railway Stations to the north end. The applications from intending exhibitors in other classes than that of lighting will be attended to this week, and it is hoped that the allotments will be issued on Saturday or Monday next.

The Chinese authorities have recently recalled a large number of students from Hartford College, U.S., under somewhat peculiar circumstances. The youths had been specially selected in China to undergo a thorough course of instruction in various branches of knowledge in the United States. They were placed under the charge of Mr. Yung Wing, who at one time held a high diplomatic post at Washington, and whose knowledge of the language and country led to his selection for this purpose. A large building for their accommodation was purchased by the Chinese Government near Hartford, and every thing seemed to be going on well. Much surprise was therefore expressed when, long before the termination of their course of study, the young men were suddenly recalled, and by this time they have all reached China. It appears that a high official of the Government, on his passage through America to Europe, examined the institution where his young countrymen were being trained. He was alarmed to find they were being rapidly Americanised, and that some had gone so far as to part with their pigtails, and dress in foreign garments. He thought also that he noticed a growth of ideas in their minds which, however congenial to a republic, were out of the question in China; that the youths' minds would gradually be alienated from their native country, and that the impressions which they were imbibing might lead to trouble and disaffection in China. He accordingly wrote to Peking, recommending the recall of the mission. His views were immediately adopted; but it is hoped that the students will not lose much, as they are about to be sent to European countries, to which the same objections do not exist as to the United States. The incident shows very clearly that, however anxious the Chinese may be for the science and knowledge of the west, they want none of its political doctrines.

On Tuesday a deputation, consisting among others of Lord Harberton, Sir Antonio Brady, the Hon. Rollo Russell, Capt. Galton, C.B., Col. Festing, R E., Prof. Chandler Roberts, F.R.S., Mr. Ernest Hart, Mr. George Shaw, and Mr. W. R. E. Coles, waited upon the Lord Mayor at the Mansion House, and asked him to open the exhibition and trials of smoke-preventing appliances now about to be held at South Kensington. The earnest effort, they said, of the Committee had been to encourage general improvement in the methods and appliances by which heat was obtained, and thus to secure the advantages of greater economy of fuel and lessened smoke. That effort had been so far successful that a very considerable number of economical and effective grates, stoves, and furnaces had been brought forward, and many improved methods of firing and other smoke-preventing means had been introduced. The Lord Mayor acceded to the request of the deputation, and the Committee promised to communicate with him as to the day of opening the exhibition, which will probably be about the end of the month.

The English Royal Commission on Technical Education have, the *Times* correspondent states, been busy in Paris in visiting the higher, the secondary, and the primary schools, and particularly those in which manual and technical instruction is provided. It is their intention to inquire into the state of instruction in the districts in which cotton, woollen, and silk manufactures are carried on, and also in some of the chief pottery manufactories abroad, and to ascertain what resources are available for the same purpose in the corresponding manufacturing districts in England—an inquiry which they have already commenced by visits to Yorkshire and Staffordshire. During the winter they will continue to study the condition of technical instruction in the English manufacturing districts, and in the spring it is their intention to visit Germany, where the chairman, Mr. Samuelson, on a late visit to Berlin, has already set on foot some preliminary investigations.

The banquet in honour of Prof. Virchow is to be held at Berlin on the 19th inst., in the Rathhaus, and promises to be highly brilliant and successful. The sum of 30,000 marks, originally proposed to be raised for the memorial, appears likely to be greatly exceeded. This memorial will consist of a marble bust of the Professor, and will be placed in the hall of the Pathological Institute on the above-mentioned day, in commemoration of his twenty-five years' labours as a teacher of medical science.

The *Morning Post* states that, among other experiments now being conducted by a chemist at the Royal Short-horn Dairy at Dytchleys, Essex, the powers of carferal, already well known as a filtering medium in the removal of ammonia from sewage, are being investigated. It has been found that all ammonia is taken up by the carferal, as is indicated by testing the fluid after it has passed through it, and the resultant is a material valuable in breaking up and manuring heavy land.

The Nürnberg Natural History Society recently made an excursion to Berg near Neumarkt (Upper Palatinate), and upon this occasion a large number of Teleosaurus bones (vertebræ and others) were found at the boundary between brown Jurassic and Lias. Besides these fine specimens of Belemnites, Ammonites. and Terebratulæ were found. The bones in question are of course completely petrified; the impressions of the scaly hide on the back are well preserved. All the objects found are now deposited in the Society's collection.

THE Pesth correspondent of the *Daily News*, telegraphing on the night of the 9th inst., states that Agram has again experienced a violent shock of earthquake. Shocks of earthquake, sufficiently severe to occasion considerable alarm, were felt at Château d'Oex, Canton Vaud, on Wednesday night and Thursday morning last week. The second of the shocks, which appear to have been altogether local, was accompanied by loud rumblings. There were three slight earthquake shocks in various parts of Switzerland last month, all local, and affecting only a very limited area. The first occurred at Monthey, in the Valais, on October 14; the second at Berne, on October 17; and the third at Zürich, on October 27. A violent earthquake was felt on October 27 at 10.30 p.m. in the northern part of the canton of Zürich. On the same day at 4.30 a.m. a slight shock was felt at Cilli and several other places in Styria.

THE death is announced of Dr. Eduard Simon Heine, Professor at Halle University, an eminent mathematician. He died at Halle on October 24 last.

WE regret to announce the death of Dr. Carl Arendts of Munich, a well-known geographer, and founder of the Geographical Society of that city. Dr. Arendts died at Possenhofen on October 11, aged sixty-seven years. He was the author of numerous standard works, and editor of the excellent *Deutsche Rundschau für Geographie und Statistik*, which has just commenced its fourth volume.

OUR readers are aware that Dr. Kobelt visited North Africa and Spain last spring, by the assistance of the Rüppell Institution of Frankfort, in order to investigate the molluscous fauna of the two countries, as well as to gather evidence bearing upon the question how far the land-connection between the two countries extended in bygone ages. He now reports that it may safely be assumed that the connection was not confined to the Straits of Gibraltar, but extended at least as far as the meridian of Oran and Cartagena. Dr. Kobelt will publish the detailed results of his investigations in the malacozoological journal, of which he is the editor.

THE Gotha Natural History Society will arrange an exhibition of natural history and geographical objects from November 20 to December 20. The Duke of Saxe-Coburg Gotha has lent the Society a suite of rooms in the Castle for this purpose.

A TUNNEL through the Col de Somport, near the Pic du Midi, in the Pyrenees, is the next large engineering work which will be undertaken in France. It will shorten the railway distance between Paris and Madrid by 100 kilomètres, the Spanish line passing by way of Ayerbe, Caldearenas, Jaca, and Confranc, leading on the French side into the Gave de Aspe valley and Oléron.

WE have before us the prospectus of a new entomological monthly journal, to be styled the *Wiener entomologische Zeitung*, of which the first part is to appear at the beginning of 1882, each part to consist of a sheet and a half of text, large 8vo. The editors are Ludwig Ganglbauer, Dr. Franz Löw, Prof. Josef Mik, Edmund Reitter, and Fritz Wachtl, all of Vienna, and it will be published by Alfred Hölder of that city. With so strong a staff it should prove a success. In some respects it is intended as a successor to the for many years defunct *Wiener entomologisches Monatsschrift.*

MR. LEO LESQUEREUX, we learn from the Harvard Library *Bulletin*, No. 3, has made a preliminary Report on the Plants of the Dakota Group collected by Mr. Sternberg for the Museum of Comparative Zoology (to be published in the *Museum Bulletin*). He says the collection is valuable in regard to the data it furnishes in confirmation of, or contradiction to, some of the general conclusions derived from the examination of the materials formerly described from this peculiar Cretaceous flora. For example, the disconnection of the flora of the Dakota group from that of the older zones—those of the Jurassic times—does not appear now so positive as formerly, or as it was indicated in the Cretaceous Flora Reports of Hayden's Survey. On the other side, the disconnection of the Cretaceous flora from that of the Lower Tertiary appears now still more evident, as the new species do not indicate any affinity with the plants of the Laramie group, which is positively Eocene by its types. Mr. Lesquereux is inclined to explain the distribution of the fossil plants of this group over small areas, as showing that the trees apparently grew around small hillocks or dry surfaces of land disseminated in wide lagoons. If derived from distant shores the leaves should be more or less mixed, while a comparison of the different localities shows that the fossil leaves were derived from trees grown in the places where they are now found fossil.

THE complete annihilation of Elm, according to the Geneva correspondent of the *Daily News*, appears to be now only a question of time and a little bad weather. At the request of the Government, Prof. Heim has just made another inspection of the Tschingel. He finds the work of disintegration proceeding much more rapidly than he expected. The entire summit of the Risikopp, the peak nearest Elm, is in movement, and its fall is not likely to be long delayed. It may miss the village, but the chance is very remote. The inhabitants remain meanwhile in their houses, which they have not to quit until the sentinels who are watching on the mountain warn them that danger is imminent.

IN Japan, according to a recent return, there are in all 159 hospitals where the patients are treated on the principles of western medicine. Thirty-five of these are private institutions in the sense that they receive no government aid, while twelve are naval or military hospitals. The remainder are scattered throughout the country; but they are said to be, in the remote districts, in a very crude condition. Vaccination, which is compulsory, is performed *gratis* everywhere. A law prohibiting the practice of physic or surgery by any except persons holding certificates of permission has recently been passed. A large school of medicine, with German professors, has been established for the past eight or ten years in the capital.

AT Nagy-Look (Hungary) the remains of a two-wheeled Roman car were lately discovered, with the skeletons of two horses attached to it. The objects are believed to date from the third century, and the place where they were found to have been the tomb of the owner. All the parts of the carriage are of most exquisite workmanship.

THE Russian Government intend to construct a canal between the Dnjepr and Düna Rivers, the Orschitsa, a tributary of the Dnjepr, to form a part of the canal. The distance by water between the Euxine and the Baltic would thus be shortened by 415 versts.

A ROUMANIAN mechanic, Traiano Feodoresen, recently submitted to the Chamber at Bucharest a project of a submarine vessel, and after examination of this by a committee the Government was authorised to meet the expense of construction. The vessel is to be capable of moving under water, at a depth of 30 metres, for twelve hours, without requiring renewal of air. Steam is the motor, and the speed is quicker than that of sailing vessels. The vessel is simply sunk by opening certain valves, but return to the surface requires more complex operations. An electric light will render objects distinguishable at 30 or 40 metres. For renewal of air it is not necessary that the vessel rise to the surface; an apparatus can be sent up, which, by actuating a pump, forces air into suitable receivers.

It is often supposed that the reality of alchemy, the transformation of the base into the noble metals, was generally accepted by orientals. But, according to Herr E. Wiedemann (*Ann. der Phys.* No. 10), some of the most noted *savants* rejected the idea. In his Prolegomenon, Ibn Khaldûn maintains that the transformation of metals is impossible, the philosopher's stone cannot exist, and the study of alchemy is ruinous. His own views, however, interest us less than his citation of Avicenna and his school as opponents of alchemy. While Abn Nasir al Farâbi, an older philosopher, held that all metals belong to the same species, and differed only in accidents, so that a transformation of these into each other was possible, Avicenna maintained that the metals differed in species, and that their specific differences, ordained by God, were therefore not alterable by chemical operations. A noted alchemist, Togair, contended, against this, that the task of alchemy was not to impart these differences to metals, but only to alter the latter so that they might be enabled to acquire them; the means to this being the elixir. A great predecessor of Avicenna, Al Kindi, also appears to have opposed alchemy.

The additions to the Zoological Society's Gardens during the past week include two Vulpine Phalangers (*Phalangista vulpina*), a Rufous Rat Kangaroo (*Hypsiprymnus rufescens*) from Australia, presented by Mr. F. J. Horniman, F.Z.S.; a Ring-necked Parrakeet (*Palæornis torquata*) from India, presented by the Countess Dowager of Lonsdale; two Long-eared Owls (*Asio otus*), British, presented by the Rev. J. A. Wix; two Grey Wagtails (*Motacilla sulphurea*), British, presented by Mr. Swaysland; a Dufresne's Amazon (*Chrysotis dufresniana*) from South-East Brazil, a Yellow-cheeked Amazon (*Chrysotis autumnalis*) from Honduras, an Orange-winged Amazon (*Chrysotis amazonica*) from South America, deposited; a Pluto Monkey (*Cercopithecus pluto*), a Sykes's Monkey (*Cercopithecus albogularis*) from West Africa, a Darwin's Rhea (*Rhea darwini*) from Patagonia, a Picazuro Pigeon (*Columba picazuro*) from South America, two Spotted Zenaida Doves (*Zenaida maculata*) from La Plata, two Dominican Gulls (*Larus dominicanus*) from Antarctic America, purchased.

EXPERIMENTS ON COLOUR[1]

In a former paper with the above title (Nature, vol. iii. p. 234) I described some combinations of absorbing media capable of transmitting the red and green, while stopping the other rays of the spectrum. In this way I obtained a *purely compound* yellow, made up of red and green, and free from homogeneous yellow light. In devising such combinations we have in the first place to seek an absorbing agent capable of removing the yellow of the spectrum, while allowing the red and green to pass. For this purpose I used an alkaline infusion of litmus, or solution of chloride of chromium, placed in a trough with parallel glass sides. In order to stop the blue rays we may avail ourselves of chromate of potassium. If a second trough be not objected to, it is best to use the bichromate, as exercising the most powerful absorption upon the upper end of the spectrum; but the bichromate cannot be mixed with litmus without destroying the desired action of the latter upon yellow. In this case we must content ourselves with the neutral chromate.

During the last year and a half I have resumed these experiments with the view, if possible, of finding solid media capable of the same effects, and so of dispensing with the somewhat troublesome troughs necessary for fluids. With this object we may employ films of gelatine or of collodion, spread upon glass and impregnated with various dyes, gelatine being chosen when the dye is soluble in water, and collodion when the dye is soluble in alcohol. Thus in the case of litmus a slightly warmed plate is coated with a hot and carefully filtered solution of gelatine, allowed to remain in a perfectly horizontal position until the gelatine is set, and then put aside to dry, by preference in a current of warm air. The films thus obtained are usually somewhat rough upon the surface, so that I have preferred to use two pieces cemented together, coated sides inwards, with Canada balsam. In conjunction with the litmus we may employ a silver-stained orange glass, and so isolate the red and green rays. For the orange glass Mr. C. Horner has substituted a film of collodion stained with aurine. Samples possibly vary; but that which I have used, though extremely opaque to the blue-green rays, and therefore so far very suitable for the purpose, allows a considerable quantity of the higher blue to pass. By spreading aurine upon a pale yellow glass, I obtained a very perfect absorption of the blue-green and higher rays. Plates prepared as above described answer the purpose very well; but I have found that in some cases the litmus in contact with the balsam becomes slowly reddened, the action creeping inwards from the edge. A dye, capable of replacing litmus, and free from this defect, is "soluble aniline blue," whose absorption, as I found rather unexpectedly, begins in the yellow and orange. Bichromate of potash and aniline blue may be mixed in the same solution, and there is no difficulty in so adjusting the proportions as to secure a good compound yellow. To obtain solid films gelatine must be used, as in the case of litmus, for the dye is not soluble in collodion. With aniline there is no difficulty from the Canada balsam, and two plates cemented together answer perfectly.

For systematic observations on compound colours nothing probably can be better than Maxwell's colour box in its original form; but it seemed to me that for the examination of certain special questions a more portable arrangement would be convenient. In an instrument of this class a full degree of brightness requires that the width of the eye-slit, placed where the spectrum is formed, should not contract the aperture of the eye, *i.e.* should not be less than about one-fifth of an inch; and although the maximum of brightness is not necessary, considerations of this kind largely influence the design. If we regard the width of the eye-slit as given, a certain length of spectrum is necessary in order to attain the desired standard in respect of purity of colour; so that what we have to aim at is a sufficient linear extension of the spectrum. A suitable compromise can then be made between the claims of brightness and purity.

The necessary length of spectrum can be obtained by increasing either the angular dispersion of the prisms or the focal length of the lens by which the image is formed. If portability be no object, the latter is the preferable method, and the focal length may well be increased up to five or six feet; in this way we may obtain a field of view of given purity of colour and of maximum brightness, at the expense only of its angular extent. If, however, we desire an instrument which can be moved from one place to another without losing its adjustment, the focal length of the lenses must be kept down, and then a large prismatic dispersion is the only alternative.

Increased dispersion can of course be obtained by multiplication of prisms; but for the purpose in view, high resolving power is not wanted, and our object may be attained with a comparatively small total thickness of glass, either by the use of higher angles than usual, or by giving the light a more nearly grazing emergence. The latter was the course adopted in designing the first instrument of which I have to speak. A pair of prisms of 60°, cut from an ordinary single 1¼ × 1¼-inch prism along a plane bisecting at right angles its refracting edge, were arranged in the corner of a shallow box, so as to form what Thollon calls a *couple*. Considered as a simple, rigidly connected refractor, the pair of prisms are placed so as to give minimum deviation, but the incident and emergent light makes smaller angles with the final surface, than if each prism were adjusted separately for minimum deviation. The collimating and focussing lenses are common spectacle glasses of about 8″ focus. The box is 12″ × 12″ × 3″. Light entering at a slit on one of the sides of the box would be turned by the prisms through an angle rather greater than a right angle, and throw a pure spectrum upon another side of the box. This side is cut away, and provided with movable screens of cardboard, so that any part may be open or closed as desired. When the eye is applied to the first slit, the prisms are seen uniformly illuminated with colours whose composition depends upon the situation and width of the slits between the cardboard screens through which light is allowed to enter. In this way we may obtain a uniform field of view lighted with any combination of spectral colours. My object, however, was to obtain an instrument for making comparisons between the simple and compound yellow, and for this purpose an addition was necessary. This consisted

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[1] Read before Section A of the British Association, September 2, 1881, by Lord Rayleigh, F.R.S.